

Accelerating Random Vibration Tests

The old adage “time is money” is pertinent to the vibration industry. Vibration test facilities want to accurately test products but do so in an efficient time period. Vibration Research Corporation has two techniques to help test engineers rapidly accelerate the random vibration tests. Those two methods are Kurtosis Control and Fatigue Damage Spectrum.

Kurtosis Control (Kurtosion®)

For test engineers who want to break products quickly there are a number of random vibration test options available. As discussed in previous papers, there is Vibration Research Corporation’s patented Kurtosion® method. With Kurtosion® test engineers can accelerate test times by putting the large and damaging resonant peaks that are found in the real-life data back into the random test. With traditional testing methods those large resonant peaks would be averaged out by the controller. But with Kurtosion®, the large resonant peaks are included in the random vibration test. In doing this, the test engineer does NOT add any new energy to the system – the PSD plot remains the same at all frequencies when the kurtosis level is increased. With this method, the total energy of the test remains the same. All that will change is the distribution of that energy so that there is a greater occurrence of the large resonant peaks that aid in destroying the product more quickly. With Kurtosion®, test engineers can bring products to failure more quickly ***without increasing the total energy of the test.***

Fatigue Damage Spectrum

Another test option available to test engineers is Vibration Research Corporation’s newly developed Fatigue Damage Spectrum. With the Fatigue Damage Spectrum (FDS), test engineers accelerate the test time for the life of a product, ***by increasing the energy of the system.*** Test engineers can crank up the RMS of a test to destroy a product more quickly if they like. But to what level should they crank up the RMS? The answer to that question depends (within reason) on how long of a test the engineer wants to run. With FDS, the test engineer uses the principle of Miner’s Rule of Damage. Fatigue damage will accumulate for a product until the life-dose of fatigue for that product has been met. At that point, the product will experience some failure. Knowing this, test engineers can be confident that no matter what RMS level they choose, the total amount of fatigue for the product will not increase. From a recorded waveform, VibrationView software can compute the Fatigue Damage Spectrum for a particular product. Based on that FDS, test engineers can set the test duration for whatever value they desire and a corresponding RMS value will be computed. In this way the exact amount of RMS (energy for the test) can be computed to bring about the failure of the product in the desired length of test time.

Conclusion

Test engineers like to accelerate the life-test of a product. With VRC’s VibrationView software they can choose how they want to accomplish the accelerated random vibration test. Test engineers can accelerate the test ***by keeping the RMS values the same*** but redistributing the energy so as to give the test more high-energy peaks. This is the method of Kurtosion®. Alternatively, test engineers can accelerate the test ***by increasing the RMS values.*** They can intelligently do this by using the Fatigue Damage Spectrum and a reasonable test duration for the product.